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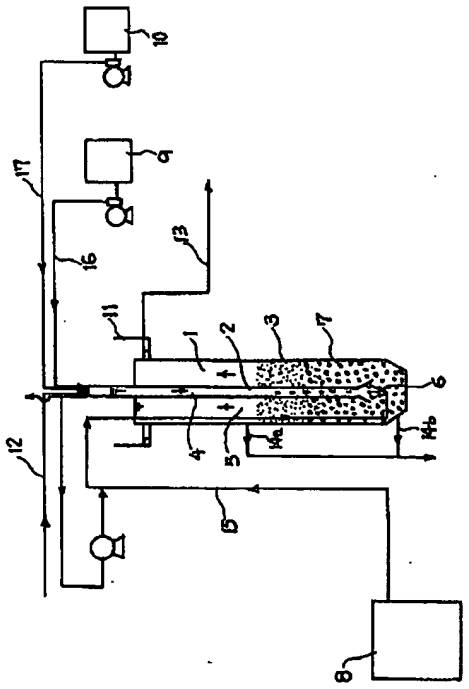
(54)【発明の名称】　汚水の生物学的処理方法

(57)【要約】
【目的】汚水を高負荷で処理でき、且つ単一槽内で硝化、脱窒処理することにより効率的な処理と、低廉な設備費や設置面積の削減を可能とした汚水の生物学的処理方法を提供する。
【構成】汚水を生物学的処理するにあたって、下降流路と上昇流路とを設けた生物反応槽の上昇流路下部に、自己造粒汚泥床を形成し、下降流路に酸素富有ガスを間欠的に供給して、好気、嫌気の状態を交互に生じさせて処理する汚水の処理方法。



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【特許請求の範囲】

【請求項１】汚水が流通する下降流路と上昇流路とを有する生物反応槽で汚水を生物学的に処理する方法において、前記上昇流路の下部に自己造粒汚泥床を形成し、前記下降流路に酸素富有ガスを間欠的に供給して好気、嫌気の状態を交互に生じさせて処理することを特徴とする汚水の生物学的処理方法

【請求項２】前記生物反応槽に凝集剤を添加して自己造粒汚泥床の形成促進を図ることを特徴とする請求項１記載の汚水の生物学的処理方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、下水などの有機性汚水を、単一の生物反応槽内に好気、嫌気の状態を交互に生じさせるとともに、自己汚泥床を形成して処理する汚水の生物学的な処理方法に関する。

【０００２】

【従来の技術】従来の生物学的処理方法としては、浮遊式の活性汚泥法、回転円板法、接触酸化法等の生物膜法が主流となっているが、近年は微生物の自己造粒汚泥床を形成した生物反応槽内に、汚水を上向流で供給し、前記汚泥床を反応槽下部で流動させ、嫌気または好気の状態で処理する上向流スラッジブランケット法も用いられてきており、特に嫌気処理においては活発に実施化されている。

【０００３】前記上向流スラッジブランケット法は、被処理成分を生物学的に分解処理する微生物が粒子化され、高密度に保持されるため、高容積負荷での運転が可能となり、効率的に汚水を処理することができる利点がある。

【０００４】一方、反応槽内での曝気を間欠的に行い、槽内に好気、嫌気の状態を交互に生じさせて硝化脱窒作用を促進し、また固液分離も槽内で行って単一槽内で処理する、活性汚泥法の変法である回分式処理法も用いられている。本方法は沈澱槽などが不要なため設備の設置面積も少なく、また運転操作も容易であるため、特に小規模処理方法として適用されている。

【０００５】

【発明が解決しようとする課題】前記従来の処理方法において、上向流スラッジブランケット法にあっては、硝化または脱窒処理を別工程として設けており、また汚泥と処理水とを分離する沈澱槽も別に必要となるため、設備費や設置面積も過大となる欠点がある。

【０００６】また回分式処理法にあっては、通常の活性汚泥法と同様に、微生物濃度を高く保持することができないため、汚水を高容積負荷で処理することができず、処理効率が低くなる欠点がある。

【０００７】従って本発明は、前記上向流スラッジブランケット法や回分式処理法等の利点を生かし、汚水を高負荷で処理でき、且つ単一槽内で硝化、脱窒処理するこ

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とにより、効率的な処理と低廉な設備費、設置面積の節減を可能とした汚水の生物学的処理方法を提供することを目的として成されたものである。

【０００８】

【課題を解決するための手段】本発明の要旨は、汚水が流通する下降流路と上昇流路とを有する生物反応槽で汚水を生物学的に処理する方法において、前記上昇流路の下部に自己造粒汚泥床を形成し、前記下降流路に酸素富有ガスを間欠的に供給して好気、嫌気の状態を交互に生じさせて処理することを特徴とする汚水の生物学的処理方法であり、また前記生物反応槽に凝集剤を添加して、自己造粒汚泥床の形成促進を図ったことを特徴とする汚水の生物学的処理方法である。

【０００９】

【作用】運転開始の初期においては、汚水と下水汚泥を生物反応槽に充填し、汚水を下降流路から供給し、一定期間上昇流路を所定の上昇速度で流通させることにより、軽い汚泥が流出され、重い微生物汚泥のみが残留されて増殖し、ついには粒子化して上昇流路下部で自己造粒汚泥床が形成される。

【００１０】前記において、生物反応槽内に凝集剤を適宜に添加することにより、微生物の凝集が促進され、粒子化期間を短縮することができる。また更に期間を短縮するために、最初から他の装置で生成された造粒汚泥を充填することも適宜におこなわれる。

【００１１】尚、下降流路から供給される汚水に、酸素富有ガスを一定の時間間隔で間欠的に供給することにより、生物反応槽の上昇流路内に好気、嫌気の状態を交互に生じさせる。

【００１２】定常の運転時には汚水は、自己造粒汚泥床の粒子化微生物の生物学的作用により、汚水中のＢＯＤ成分が消化分解され、また窒素分は好気状態での硝化と嫌気状態での脱窒反応により分解され、更に燐分も嫌気状態での放出と好気状態での過剰な摂取により、微生物内に取り込まれ除去される。

【００１３】

【実施例】以下本発明の実施例を説明する。図１は本発明の一実施例の方法を適用した装置の系統図である。１は生物反応槽であり、供給汚水の下降流路４を形成し酸素を溶解させる内筒２と、上昇流路５を形成し自己造粒汚泥床７で生物学的処理を行う外筒３の二重筒構造となっている。

【００１４】また前記内筒２の下端には、酸素富有ガス供給装置８から供給される酸素富有ガスの供給管１５に接続された散気器６が配設されている。更に内筒２の上部には汚水の供給管１２と、ポリ塩化アルミニウム（ＰＡＣ）や水酸化カルシュウムなどの凝集剤槽９、１０からの凝集剤供給管１６、１７が接続されている。

【００１５】尚、図示していないが、汚水の性状や供給量などによって凝集剤の添加量を調整する制御装置が付

設されている。また前記酸素富有ガス供給装置8としては、酸素ボンベ、ＰＳＡ装置、膜分離装置などを用いることができる。

【００１６】外筒3の上端には、処理水のオーバーフロー溜まり１１が環状に設けられ、処理水排出管１３が接続されており、また外筒3の中間部及び下部には、余剰な汚泥を排出する余剰汚泥排出管１４ａ、１４ｂが接続されている。

【００１７】また内筒2と外筒3とで形成された上昇流路5の下部には、微生物の自己造粒汚泥床7が形成されており、本汚泥床7は汚水の上昇流速により、一定の高さで流動しながらバランスして保持されている。

【００１８】尚、図示していないが必要に応じ、自己造粒汚泥と被処理水との接触をよくするとともに、生物処理で生じた炭酸ガスや窒素ガス等の気体を脱離させるために、緩やかな撹拌を行う撹拌装置を設けるのが好ましい。

【００１９】前記構成の装置により下水の一次処理水を原水として、本発明の方法で処理した一実施例について以下述べる。生物反応槽1に下水汚泥を充填し、原水を、上昇流路5での上昇速度が1～2m／Hrとなるように、下降流路4の上部から供給した。

【００２０】同時に酸素富有ガス供給装置8からの酸素富有ガスを、供給時間／停止時間：３０分／３０分として間欠的に供給し、また凝集剤としてポリ塩化アルミニューム（ＰＡＣ）を４０ｍｇ／ｌ添加した。

【００２１】その結果、約4週間後には自己造粒汚泥が確認され、１．５か月後には自己造粒汚泥床7が形成され、定常運転が可能となった。定常運転時の運転条件としては、液滞留時間：６Ｈｒ、造粒汚泥床での平均汚泥濃度：５８４００ｍｇ／ｌ、液温度：２２℃で行った。また酸素富有ガスの間欠供給により、生物反応槽1内の溶存酸素濃度は０．５～１．５ｐｐｍの好気状態及び溶存酸素の無い嫌気状態を交互に繰り返し生じた。

【００２２】前記の条件によって処理した結果、原水は、ＰＨ：７．８、ＢＯＤ：１４０ｐｐｍ、ＳＳ：１６２ｐｐｍ、Ｔ－Ｎ：３６ｐｐｍ、Ｔ－Ｐ：４．５ｐｐｍの水質が、処理後には、ＰＨ６．６ｐｐｍ、ＢＯＤ：８．５ｐｐｍ、ＳＳ：１２ｐｐｍ、Ｔ－Ｎ：３．３ｐｐｍ、、Ｔ－Ｐ：０．３ｐｐｍとなった。

【００２３】前記実施例で示した通り、凝集剤を添加しない場合には、約3か月かかる自己造粒汚泥床の形成も約１．５か月となり、極めて短期間に短縮された。また脱窒、脱燐処理においても９０％以上除去処理されることが判明した。

【００２４】

【発明の効果】本発明の方法によれば下記の効果が得られる。

イ）好気、嫌気を交互に繰り返すことによりＢＯＤ成分、窒素分、燐分除去を単一槽で処理でき、また処理水と汚泥とを分離する沈澱槽が不要なため、装置の設置面積も少なくできる。

ロ）自己造粒汚泥床を形成することにより、微生物を高密度に保持でき、効率的な処理が可能である。

ハ）汚泥を返送する必要がなく装置が簡略化され運転操作も容易である。

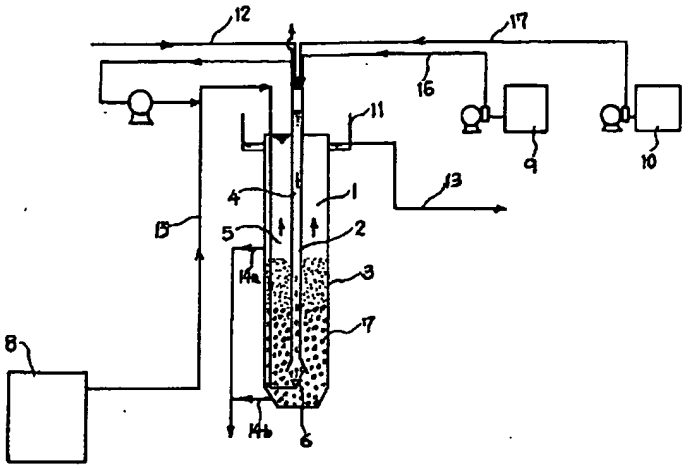
【図面の簡単な説明】

【図１】本発明を適用した一実施例の系統図

【符号の説明】

１：生物反応槽、２：内筒、３：外筒、４：下降流路、５：上昇流路、６：散気器、７：自己造粒汚泥床、８：酸素富有ガス供給装置、９、１０：凝集剤槽、１１：オーバーフロー溜まり、１２：汚水供給管、１３：処理水排出管、１４ａ、１４ｂ：余剰汚泥排出管、１５：酸素富有ガス供給管、１６、１７：凝集剤供給管。

【図1】



DERWENT-ACC-NO: 1994-031117

DERWENT-WEEK: 199404

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TITLE: Biological treatment for sewage in biotic tank - having lower passage operating alternately in aerobic and anaerobic conditions, self-granulating sludge bed formed in upper passage, etc

PATENT-ASSIGNEE: MITSUBISHI KAKOKI KAISHA[MISK]

PRIORITY-DATA: 1992JP-0169908 (June 5, 1992)

PATENT-FAMILY:

PUB-NO	PUB-DATE	LANGUAGE	PAGES	MAIN-IPC
JP 05337492 A	December 21, 1993	N/A	004	C02F 003/30

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
JP 05337492A	N/A	1992JP-0169908	June 5, 1992

INT-CL (IPC): C02F003/30

ABSTRACTED-PUB-NO: JP 05337492A

BASIC-ABSTRACT:

Sewage is biologically treated in a biotic reaction tank having a lower passage and an upper passage for passing sewage. A self-granulating sludge bed is formed on the lower part of the upper passage. An oxygen-enriched gas is intermittently supplied to the lower passage to alternately generate aerobic condition and anaerobic condition. A coagulant is added to the biotic reaction tank to promote the formation of the self-granulating sludge bed.

USE/ADVANTAGE - Repeating the aerobic condition and the anaerobic condition
alternately treats BOD, nitrogen, and phosphorus removal in a single tank. No
sedimentation tank for sepg. treating water from the sludge is required. The
use of the self-granulating sludge bed retains microorganisms at high density,
allowing efficient treatment. Returning the sludge is not required, simplifying facilities, and assuring easy operation.

CHOSEN-DRAWING: Dwg.0/1

TITLE-TERMS: BIOLOGICAL TREAT SEWAGE BIOTIC TANK LOWER PASSAGE OPERATE
ALTERNATE AEROBIC ANAEROBIC CONDITION SELF **GRANULE SLUDGE** BED
FORMING UPPER PASSAGE

DERWENT-CLASS: D15

CPI-CODES: D04-A01B; D04-A01J; D04-A01K; D04-B07B; D04-B07C;

SECONDARY-ACC-NO:
CPI Secondary Accession Numbers: C1994-013985

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the biological art of the sanitary sewage which forms a self-sludge floor and processes organic nature sanitary sewage, such as sewage, while producing the condition of aerobic and an aversion by turns in a single living thing reaction vessel.
[0002]
[Description of the Prior Art] As the conventional biological-waste-treatment approach, although biofilm processes, such as an activated sludge process of a floating type, a rotary disc method, and contact oxidation method, are in use, the sanitary sewage is supplied by the upper counterflow in the living thing reaction vessel in which the self-granulation sludge floor of a microorganism was formed, and said sludge floor is made to flow in the reaction-vessel lower part, and the upper counterflow sludge blanket method processed in the state of an aversion or aerobic is also used, and it is actively operation-ized especially in aversion processing in recent years.
[0003] Since the microorganism which carries out decomposition processing of the processed component biologically is particle-ized and is held at high density, operation of said upper counterflow sludge blanket method with high volume load is attained, and it has the advantage which can process the sanitary sewage efficiently.
[0004] The batch process approach which performs aeration within a reaction vessel intermittently, is made to produce the condition of aerobic and an aversion by turns in a tub on the other hand, promotes nitrification denitrification, and also performs solid liquid separation within a tub and processes it within a single tub and which is a strange method of an activated sludge process is also used. Since the settling tank etc. is unnecessary, since operation is also easy, this approach is applied especially as a small-scale art that there is little installation area of a facility.
[0005]
[Problem(s) to be Solved by the Invention] In said conventional art, if it is in the upper counterflow sludge blanket method, since the settling tank which has prepared nitrification or denitrification processing as another process, and separates sludge and treated water is also independently needed, there is a fault which becomes excessive [an installation cost or installation area].
[0006] Moreover, like the usual activated sludge process, if it is in a batch process approach, since microorganism concentration cannot be held highly, the sanitary sewage cannot be processed with high volume load, but there is a fault to which processing effectiveness becomes low.
[0007] Therefore, this invention is accomplished for the purpose of offering the biological-waste-treatment approach of the sanitary sewage which could process the sanitary sewage with the heavy load, and enabled reduction of efficient processing, a cheap installation cost, and installation area nitrification and by carrying out denitrification processing within the single tub taking advantage of advantages, such as said upper counterflow sludge blanket method, batch process approach, etc.
[0008]
[Means for Solving the Problem] In the approach of processing the sanitary sewage biologically by the living thing reaction vessel in which the summary of this invention has the downward flow way where the sanitary sewage circulates, and an upward flow way A self-granulation sludge floor is formed in the

lower part of said upward flow way, and oxygen richness gas is intermittently supplied to said downward flow way. Aerobic, It is the biological-waste-treatment approach of the sanitary sewage characterized by making it generated by turns and processing the condition of an aversion, and is the biological-waste-treatment approach of the sanitary sewage characterized by having added the flocculant to said living thing reaction vessel, and aiming at promotion of formation of a self-granulation sludge floor.

[0009]

[Function] in the early stages of a start up, by filling up a living thing reaction vessel with the sanitary sewage and sludge, supplying the sanitary sewage from a downward flow way, and circulating a fixed period upward flow way with a predetermined climbing speed, light sludge flows out and only heavy microorganism sludge remains -- having -- increasing -- just -- being alike -- it particle-izes and a self-granulation sludge floor is formed in the upward flow way lower part.

[0010] In the above, by adding a flocculant suitably in a living thing reaction vessel, condensation of a microorganism is promoted and a particle-ized period can be shortened. Furthermore, in order to shorten a period, being filled up with the granulation sludge generated with other equipments from the beginning is also performed suitably.

[0011] In addition, the sanitary sewage supplied from a downward flow way is made to produce the condition of aerobic and an aversion by turns in the upward flow way of a living thing reaction vessel by supplying oxygen richness gas intermittently with a fixed time interval.

[0012] At the time of operation of a stationary, as for the sanitary sewage, digestive decomposition of the BOD component in the sanitary sewage is carried out by biological operation of the particle-ized microorganism of a self-granulation sludge floor, and it is decomposed by the denitrification reaction in the nitrification and the anaerobic condition in an aerobic condition, and further, a part for phosphorus is also incorporated in a microorganism by emission by the anaerobic condition, and the superfluous intake by the aerobic condition, and nitrogen content is removed.

[0013]

[Example] The example of this invention is explained below. Drawing 1 is the schematic diagram of the equipment which applied the approach of one example of this invention. 1 is a living thing reaction vessel and has double cylinder structure of the container liner 2 in which the downward flow way 4 of the supply sanitary sewage is formed in, and oxygen is dissolved, and the outer case 3 which forms the upward flow way 5 and performs biological waste treatment to the self-granulation sludge floor 7.

[0014] Moreover, the aeration machine 6 connected to the supply pipe 15 of the oxygen richness gas supplied from the oxygen richness gas transfer unit 8 is arranged in the lower limit of said container liner 2. Furthermore, the supply pipe 12 of the sanitary sewage and the flocculant supply pipes 16 and 17 from the flocculant tubs 9 and 10, such as a polyaluminium chloride (PAC) and hydroxylation calcium, are connected to the upper part of a container liner 2.

[0015] In addition, although not illustrated, the control unit which adjusts the addition of a flocculant with description, the amount of supply, etc. of the sanitary sewage is attached. Moreover, as said oxygen richness gas transfer unit 8, an oxygen cylinder, PSA equipment, a membrane separation device, etc. can be used.

[0016] In the upper limit of an outer case 3, it is overflow of treated water. - It collects, 11 is prepared annularly, and the treated water exhaust pipe 13 is connected, and the excess sludge exhaust pipes 14a and 14b which discharge surplus sludge are connected to the pars intermedia and the lower part of an outer case 3.

[0017] Moreover, the self-granulation sludge floor 7 of a microorganism is formed in the lower part of the upward flow way 5 formed with the container liner 2 and the outer case 3, by the rise rate of flow of the sanitary sewage, flowing in fixed height, it balances and this sludge floor 7 is held.

[0018] In addition, although not illustrated, while improving contact in self-granulation sludge and processed water if needed, in order to desorb gases produced in biological treatment, such as carbon dioxide gas and nitrogen gas, it is desirable to form the stirring equipment which performs loose stirring.

[0019] The equipment of said configuration describes below one example processed by the approach of this invention by using the primary treatment water of sewage as raw water. The living thing reaction vessel 1 was filled up with sludge, and raw water was supplied from the upper part of the downward flow way 4 so that the climbing speed in the upward flow way 5 might serve as 1 - 2 m/Hr.
[0020] The oxygen richness gas from the oxygen richness gas transfer unit 8 was intermittently supplied to coincidence as supply time amount / stop-time:30 minute /, and 30 minutes, and 40 mg/l addition of the Pori chlorination aluminum (PAC) was carried out as a flocculant.
[0021] Consequently, self-granulation sludge was checked after about four weeks, 1.5 months after the self-granulation sludge floor 7 was formed, and steady operation became possible. As a service condition at the time of steady operation, it carried out at :22 degree C whenever [liquid residence-time:6Hr, average sludge concentration:58400 mg/l / in a granulation sludge floor /, and solution temperature]. Moreover, by intermittent supply of oxygen richness gas, the dissolved oxygen concentration in the living thing reaction vessel 1 repeated the anaerobic condition without a 0.5-1.5 ppm aerobic condition and dissolved oxygen by turns, and arose.
[0022] As a result of processing according to the aforementioned conditions, as for raw water, water quality (PH:7.8, BOD:140ppm, SS:162ppm, T-N:36ppm, and T-P:4.5ppm) was set to PH6.6ppm, BOD:8.5ppm, SS:12ppm, T-N:3.3ppm, and T-P:0.3ppm after processing.
[0023] When a flocculant was not added as said example showed, for about three months, formation of this self-granulation sludge floor also became about 1.5 months, and was shortened extremely for a short period of time. Moreover, it became clear that removal processing was carried out 90% or more also in denitrification and the removal treatment of phosphorus.
[0024]
[Effect of the Invention] According to the approach of this invention, the following effectiveness is acquired.
b) Since the settling tank which can process BOD component, nitrogen content, and phosphorus part removal by the single tub, and separates treated water and sludge by repeating aerobic and an aversion by turns is unnecessary, installation area of equipment can also be lessened.
b) By forming a self-granulation sludge floor, a microorganism can be held to high density and efficient processing is possible.
c) It is not necessary to return sludge, equipment is simplified, and operation is also easy.